

## WAM Chapter 2

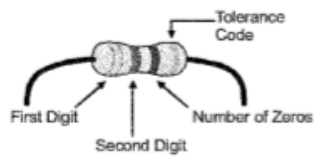
# Hardware

Resistor - what is it?

Resistor Color Code

**Table 2-1:**  
Resistor Color  
Code Values

Digit	Color
0	Black
1	Brown
2	Red
3	Orange
4	Yellow
5	Green
6	Blue
7	Violet
8	Gray
9	White



## The LED - what is it?

**Schematic Symbol**

**Current Direction**

**Component lead identification**

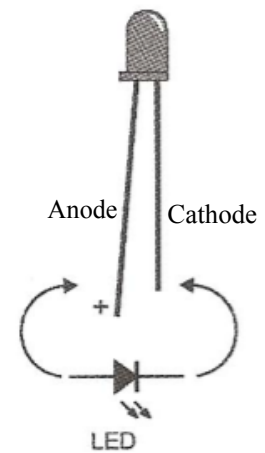
**+ Anode, longer lead**

**- Cathode, flat piece of circle**

Anode- positive electrode. In electrolysis anions are attracted to the anode. In an electronic vacuum tube it attracts electrons from the cathode and it is therefore from the anode that electrons flow out of the device. In these instances the anode is made positive by external means; however in a voltaic cell the anode is the electrode that spontaneously becomes positive and therefore attracts electrons to it from the external circuit.

**Vdd - Positive (+5 in our circuits)**

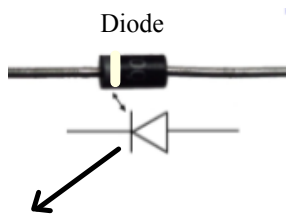
**Vss - Negative (Ground)**



**TRUE, but very confusing!**  
**Do not worry about that.**

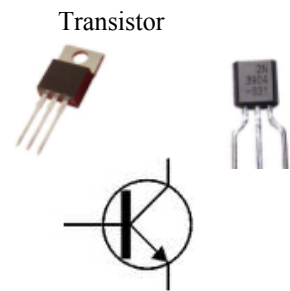
Two ways of speaking about current flow:

1. The positive charges are moving - Conventional Current  
Look at the schematic symbols



**Cathode -**

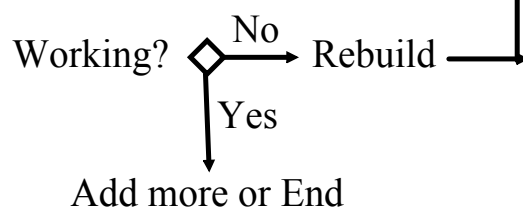
The arrow points in the direction of the conventional current.



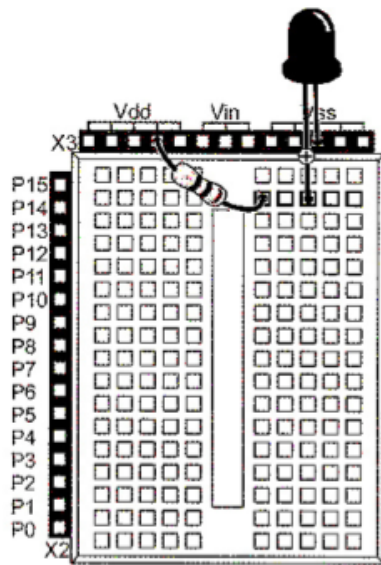
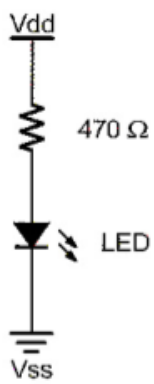
2. Electrons are moving - Electron Flow  
This is what actually happens in metallic conductors.  
This is usually the way HIGH SCHOOL physics courses describe current. College courses usually deal with conventional current.

## Development Cycle

1. Design circuit
2. Test component
3. Build Circuit
4. Test Circuit



Why do we test each component?



**Figure 2-6**  
LED On

*Schematic (left) and  
Wiring Diagram (right)*

**Output Commands:**

**HIGH n**

**LOW n**

**n is the port number**

# Programming

## Variables:

**Symbols (must start with a letter, may contain letters, numbers, and the underscore, max 32 characters, may not be reserved words) which may take on different values during program execution. They actually represent memory locations.**

## Declaration of a variable:

**counter VAR Type**

**Type may be Bit, Nib, Byte, Word**

**A bit can be a 0 or a 1**

**A nibble is 4 bits and can count 0 to 15**

**A byte is 8 bits and can count 0 to 255**

**A word is 16 bits and can count 0 to 65535**

**Delay execution of next command**

**PAUSE n**

**n is the number of milliseconds and may be a variable,  
a constant, or an expression.**

**A millisecond (ms) is 1/1000 second.**

**Pause 1000 would delay the execution  
of the next command for 1 second.**

**Programming concepts:**

**A loop is an instruction or group of instructions which is executed more than once.**

**A loop may be constructed in several ways. One is called the DO loop. This is potentially an infinite loop.**

```
Do
  ...
  ...
  ...
Loop
```

**Another construction is called the for/next loop. It is controlled by a variable.**

```
For counter = 1 to 10
  ...
  ...
  ...
Next
```

Note: For and Next ALWAYS occur in pairs!



## More Advanced Programming concepts:

### Loops:

**Do {while |until condition}**



...

**Loop {while|until condition}**



